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JEFFREY J. PETERSON *
HOWARD F. PEET**
ANTONY C. EDWARDS**A
TRACY L. CAMPS

Registered Trade-mark Agent
SUSAN M. BELIVEAU

Telephone: (250) 861-4022
Facsimile: (250) 862-3937

Century Place
Suite 206 - 347 Leon Avenue
Kelowna, British Columbia
Canada, V1Y 8C7

Our File No. TE/7324
Your File No.

November 21, 2001

The Commissioner of Patents
Ottawa, Canada
K1A 0C9

Dear Sir:

Re: Canadian Patent Application No. 2,205,782 08822947
Filed: March 21, 1997
Title: *Position-Based Integrated Motion Controlled Curve Sawing*
Inventors: Kennedy, Joe B. et al
Owner: CAE Inc.(formerly CAE Electronics Ltd. CAE Electronique Ltee)
Priority from: U.S. Provisional Patent Applications No. 60/013,803 filed March 21, 1996; No. 60/015,825 filed April 17, 1996 and No. 60/025,086 filed August 30, 1996

Please confirm the above-noted application is in good standing and there are no outstanding office actions that require any response by the applicant.

Please also indicate when we can expect to here back from the Examiner.

Yours truly,

BISHOP & COMPANY

Per:

ANTONY C. EDWARDS

ACE/nk

curve 8\ca\status-cpo

sawing. As shown in Fig. 6 A and 6 B, there are therefore two guiding systems comprising a pre-aligner 60 A, 60 B followed by an aligner 61 A, 61 B, each comprising two bars with opposing rollers and movable in opposition and symmetrically. The log is introduced and aligned by means of all the rollers as shown in Fig. 6 A. Once sawing has started, the pre-aligner bars 60 A, 60 B are swung away as shown in Fig. 6 B, and guidance is then assured by the rollers on bars 61 A, 61 b together with the saws and eventually by knives 62 a, 62 b which follow cut seams, particularly in the outermost seams where less than perfect side boards are likely to result but the seam will most likely be at full height. After exiting, curve sawed planks and boards are obtained, which may be further sawn and which after proper drying will be straight.

The previous description has mainly regarded the curve sawing following the pith, i.e. center sawing. As already mentioned, the inventive machinery makes it possible alternatively to use the full taper sawing principle in curve sawing.

The principle of straight full taper sawing is shown in Fig. 1 B, and the idea then is to let the block be guided along a material long linebar at one side, which linebar is parallel to the cutting or sawing direction. In curve full taper sawing, as shown in Fig. 1 D, the linebar is then exchanged for a set of rollers which are kept immobile, mounted on one side of the block, with opposite rollers which move to fit the changing width of the block. As the distance between the two fixed-axis rollers forming the "linebar" is short, a curved block will still be cut along a curve.

In order to obtain the possibility of working with both methods, it is necessary for the roller pairs of the chipper canter to either move in a coupled way to and from

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a common center, or let one roller stay fixed, whereas the opposite roller can move to and from the fixed roller. Such a roller pair construction will be described.

When the sawing line of Fig. 2 is to perform a full-taper sawing, the pre-aligning step as shown in Fig. 3 B is performed by setting rollers 30 A and 31 A along a non--material linebar, outside of the cutoff plane defined by cutter head 40 A. Also roller 33 A is set colinear with the same non-material linebar. As shown in Fig. 4B, rollers 30 A, B are lifted off when the block is final aligned by roller pairs 31 A, B and 33 A, B. In the sawing operation (Fig. 5 B), the guidance is given by roller 41 A, fixed on the imaginary "linebar", and movable roller 41 B before the chipper canter, and by anvils 42 A, B after the chipper canter. Roller 41 B will hold the block by resilience against fixed roller 41 A. The chipper heads being slightly toe-in (not seen in Figure), the block can be cut in a curvature, the distance being about one meter between roller 41 A and first cutting edge of cutter head 40 B. Anvils 42 A and 42 B are following the positions of the respective chipper heads 40 A, B.

In order to obtain the advantages of the invention, it is necessary to have a roller pair control mechanism which satisfies the condition that it can either be set to be movable symmetrically to a center line, or with a first roller settable to a predetermined position, the second roller of the pair being resiliently movable toward the first roller.

In the embodiment disclosed, two different methods are used for obtaining alternatively the two kinds of movement, one on mechanical principle, the other on hydraulic principle.

The first method is used for roller pairs 30 A, B, 31 A, B

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and 33 A, B shown in Fig. 3-5. Fig. 7, 8 and 9 show the method. Two rollers 80 A, B are mounted on links 81 A, B, which are swingable around swing-points 82 A, B. Fixed on respective links 81 A, B are arms 83 A, B, the ends of which are articulately coupled at 83 A, B to respective ends of a first hydraulic cylinder 84. On link 81 B is further fixed a further arm 85, to which is articulately fixed one end of a second hydraulic cylinder 86, the other end of which is articulately fixed at swinging-point 87. Swinging-points 82 A, 82 B and 87 are fixed on a carrier 88, which can be linearly displaced by a third hydraulic cylinder 89.

The advantage of this system is that symmetric movement of the jaw consisting of rollers 80 A, B can be substantially obtained, centered on line 32, by actuating only first cylinder 86, letting second cylinder at constant length (Fig. 7 A). Center line 32 may be displaced by actuating third cylinder 89.

For full taper sawing, cylinder 86 is set at a predetermined position as in Fig. 7 B, e.g. at maximum stretch. Roller 80 B will take a predetermined position. Now, roller 80 A can be moved independently by means of cylinder 84.

In order for the first-mentioned symmetric jaw movement to be substantially obtained, a certain symmetry is needed. In Fig. 7 A, the rollers 80 A, 80 B, are shown in a "mid position", corresponding to a mean block size. The first hydraulic cylinder 84 is set at minimal length and is articulately joined to arms 81 A, B at joints 83 A', 83 B', which are at equal distances from the respective fixed swinging-points 82 A, 82 B. Further, in this mid-position, lines joining 82 A - 83 A' and 82 B - 83 B' are at right angles to the line joining joints 83 A' and 83 B'. It is not difficult to see that if arm 81 B is

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swung a small angle by means of second cylinder 86, arm 81 will swing in the opposite sense and with a substantially equal angle. The error is surprisingly small within a swing angle of 12.5°, corresponding in Fig. 7 A to a closing of the "jaw". With arms 81 A, B of a length of 380 mm, the center line will only move about 0.16 mm.

An analysis shows that what is necessary for such a construction to work is that two minimum conditions must be satisfied for the position corresponding to the middle of the working interval, namely, firstly that for that position, the tierod line drawn between articulate joining points 83 A', 83 B' intersects the line between swinging--points 82 A, 82 B at its midpoint, and secondly that the normals drawn from swinging-points 82 A, 82 B to the tierod line are of equal lengths. Those conditions are sufficiently approximated for the demands at introduction.

Fig. 7 C shows the positions of the rollers when both first and second cylinders are at their shortest length. This is the infeed open position. For centersawing, thus, the second cylinder 86 is activated and will center a block relative to center line 32. For linebar full taper sawing, the second cylinder 86 is set at e.g. its maximum length, whereas the first cylinder 83 is given a pressure to bring it to shorten.

The cylinder pair 41 A, 41 B at the immediate entry of the chipper canter is controlled in another way. Fig. 8 and 9 A-B show the hydraulic system of the chipper-canter. As recited above, the chipper heads 40 A and 40 B may be individually adjustable. This is done by setting cylinders 40 A', 40 B', which each move a slide, on which the respective chipper head is mounted together with roller mechanisms for rollers 41 A, 41 B and anvils 42 A, 42 B respectively. The anvils (not shown) are strictly following the chipper heads, as they are to contact the "planes"

cut by the chipper heads. The rollers 41 A, 41 B on the other hand are to roll against the block edges as they are before chipping. According to one mode, one of them is to be held fixed, the other resiliently pressing against the block, according to the other mode, they should center the block by moving oppositely in unison.

In Fig. 8, it is shown how the chipper heads together with slides may be displaced by actuating valves 40 A", 40 B". Rollers 41 A, 41 B are displaced by cylinders 100 A, 100 B.

This hydraulic construction is sufficiently precise to guarantee high-precision sawing to obtain a product which has good tolerances.

In order to obtain the two modes of moving by means of hydraulic means, Fig. 8 and Fig. 9 A-B show the general principle. A hydralic source 101 having a pressure line P and a return line T is coupled as shown in Fig. 8 through a control device 200 provided with a switch 102 and a one-way valve 105. For each of the hydraulic cylinders 100 A and 100 B, there are provided further switches 103 and 104 respectively.

The control device receives on the input the lines P and T and outputs via the switch 103, one of the outputs passing via the one-way valve 105. Said two outputs and a direct return line coupled to T are coupled via switches 103 and 104 to the respective hydraulic cylinders 100 A and 100 B. Thereby, the output from the one-way valve 105 is split into two, making four lines go to the switches 103 and 104.

In operation, it is possible to make the cylinders work either in symmetry for curve/center sawing (Fig. 9 A) or by keeping one cylinder fixed (Fig. 9 B). For one cylinder to stand still, it is sufficient for that cylinder to have both feed lines closed, and switch 104 therefore has one

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position where both are closed, as shown in Fig. 9 B. For symmetrical inward movement, the respective switches 102, 103 and 104 are set as in Fig. 9 A. In this position, cylinder 100 B will prolong, the other side of its plunger displacing equal amounts of oil, which displaced oil will go to prolong cylinder 100 A, since one-way valve 105 will prevent that oil from returing to the T line, as shown with a bar in Fig. 9 A. The oil displaced thereby from cylinder 100 A will go freely to line T. The rollers moved by those cylinders will thus move in unison and symmetrically toward a common center. When the rollers are to move out to their opposite positions, it is sufficient to change the switch 102 and set switch 104 in its opposite position (see Fig. 9 A), and the cylinders will move to their opposite end positions, which are the starting positions for next operation.

This hydraulic movement is very precise and has further the advantage of enabling a device which has small dimensions in the length direction of the log and may therefore be placed near to each other and to cutting equipment. This makes it easier to perform curve sawing, and the hydraulic movement is preferred for the guide means nearest to the cutting/sawing devices, whereas the "mechanical" means previously described are preferred for pre-aligning purposes.

In both cases, it is suitable to have a stabilized/limited hydraulic pressure to press the rollers toward the log. An exemplary embodiment of such a stabilization is shown at 110 in Fig. 8 and consists in a bypass valve regulated by a pressure sensor for setting a suitable pressure for obtaining resilient pressure of rollers against the log.

There have now been described means for curve sawing including guide means whereby both center sawing and full taper sawing may be performed in the same machinery.

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Obviously, the various mainly hydraulic movements must be controlled such that they are activated in the right order in order to perform the described functions. The various control and sensing devices for performing this task are obvious to an engineer familiar with standard automatic control systems and would normally be computer assisted. This being the case, it has not been seen as suitable to describe the further control equipment, being well within the grasp of one familiar with the art of industrial control.

Not shown in the Figures and not described is the forward feed. As is conventional, this feed is obtained by meas of horizontal driven roller pairs, one in the bottom plane where the log is moving, another vertically adjustable, forming a roll nip with the former. As this feed is conventional, it is not described.

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CLAIMS 2022857

1. In a secondary breakdown saw line having log transport and feed means, and admitting of curve sawing, an infeed adjustment device followed by a chipper comprising two sideways movable chipper heads rotatable on horizontal shafts and a sawing device comprising a plurality of sawing means for making parallel sawing seams, which sawing device has guide roller means for guiding a log treated by the chipper heads in adjusted manner through the sawing device, the improvement comprising in said infeed adjustment device of a plurality of roller pairs rotatable on vertical shafts, and means for selecting sideways movement of the rollers in a first mode, in which the rollers are adapted to move in unison and symmetrically from and resiliently toward a common center, or, in a second mode, in which one of the rollers in each said pair is maintained at an adjustable fixed position, while the other roller of each pair is movable from said one roller and resiliently toward the roller maintained in said fixed position.

2. For chipper canter machine provided with two chipper heads rotatable on individual horizontal shafts and movable to and from each other for creating a gap for cutting vertical opposite plans on a log block guided therethrough, feeding and guiding means for bringing a log block through said gap, said guiding means comprising an infeed device having a plurality of roller pairs rotatable on vertical shafts and movable in a horizontal direction to and from a line parallel to said gap for successive entering in contact and removing from a log block transported therebetween,
a pre-guide roller pair situated immediately in front of said chipper heads, rotatable on vertical shafts and movable to and from a log transported therebetween, and a pair of guide means, each solidary in movement with one of said chipper heads and coplanar with the said vertical opposite plans cut on a log block, all said rollers being controlled for either resiliently urging in symmetric movement against a log relative to a respective midpoint or for one thereof residing fixedly and the other resiliently urging a log against the other roller of the same pair,
each pair of said plurality of roller pairs being arranged to activate movement against a log block and to remove therefrom in succession and such that when

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cutting never more than two of said pairs of said plurality of rollers, said pre-guide roller pair and said pair of guide means make contact with a log guided through the chipper canter machine.

3. A guide roller pair system for introducing logs of timber into a machine for curve sawing secondary breakdown alternatively by center sawing and full taper sawing, having a pair of parallel vertical guide rollers fixed to separate arms which are swingable around axes parallel to the respective guide rollers, and which are fixed to a frame, a first hydraulic cylinder swingably fixed with one end to one of said separate arms and with its other end to the other of said arms at fixing-points on the respective arms which have equal distances to their respective axes thereof, a line joining said fixing-points crossing another line joining said axes,
and a second hydraulic cylinder swingably fixed with one end to the frame and with its other end to a first one of said separate arms, such that a hydraulically driven change in the length of only said first hydraulic cylinder will move only the second one of said separate arms and therewith only the roller thereof, and such that a hydraulically driven change in only said second hydraulic cylinder will make the two rollers move substantially symmetrically to and from a common middle point between the two.

4. A guide roller pair system of claim 3, each roller having a useful stroke of movement toward and from each other, wherein at half said useful stroke for the two rollers, a first line drawn between the fixing points of said first hydraulic cylinder forms right ranges with respective lines drawn from said fixing points to said respective axes for swinging said separate arms, and a second line drawn between said respective axes intersects said first line at its midpoint.

5. A guide roller pair system for guiding logs through a log cutting device and permitting of cutting curvedly and selectably according to a center cutting or a full taper principle, said rollers of the pair being rotatable on vertical shafts and movable in directions perpendicular to their shafts, each roller in the pair being movable by a hydraulic cylinder of equal diameter, a hydraulic fluid source for a substantially incompressible fluid, said source

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having a pressure output and a return input, and feed control means for feeding fluid to said two hydraulic cylinders including means for feeding in a first operation mode of said fluid from said pressure output to a first of said hydraulic cylinders at one end thereof for nearing its said roller toward the other roller, and for feeding fluid thereby expelled from the other end of said first hydraulic cylinder exclusively to the second of said hydraulic cylinders at one end thereof for nearing its said roller toward the said first-mentioned roller with equal amount, and for feeding fluid expelled from the other end of said second hydraulic cylinder to said return input, and in a second operation mode to feed said fluid from said pressure output only to said first of said hydraulic cylinders at said one end thereof, and for feeding fluid thereby expelled from the other end thereof to said return input, said second hydraulic cylinder being immobilized by said feed control means.

6. A guide roller pair system of claim 5, wherein said feed control system comprises a shunting pressure control system for controlling the pressure at the source pressure output and for obtaining a resilience of said rollers when moving against a log introduced between said pair of rollers.

7. A guide roller pair of claim 5 or 6, wherein said feed control system comprises a first switch having two inputs and a first and a second output, for switching said pressure input and return input of said source alternatively to said first and second outputs, a one-way valve coupled with its allowing entrance to the first of said outputs and with its allowing exit to an input of each of a second and third switch, said second output of said first switch being coupled to another input of said second switch, said return input of said source being also coupled to an input of said third switch, said second and third switches having outputs coupled to opposite ends of said hydraulic cylinders, said second switch allowing of switching its said inputs alternately to its said outputs, said third switch allowing of switching its said inputs alternately to its said outputs and also allowing of breaking connection to its said outputs.

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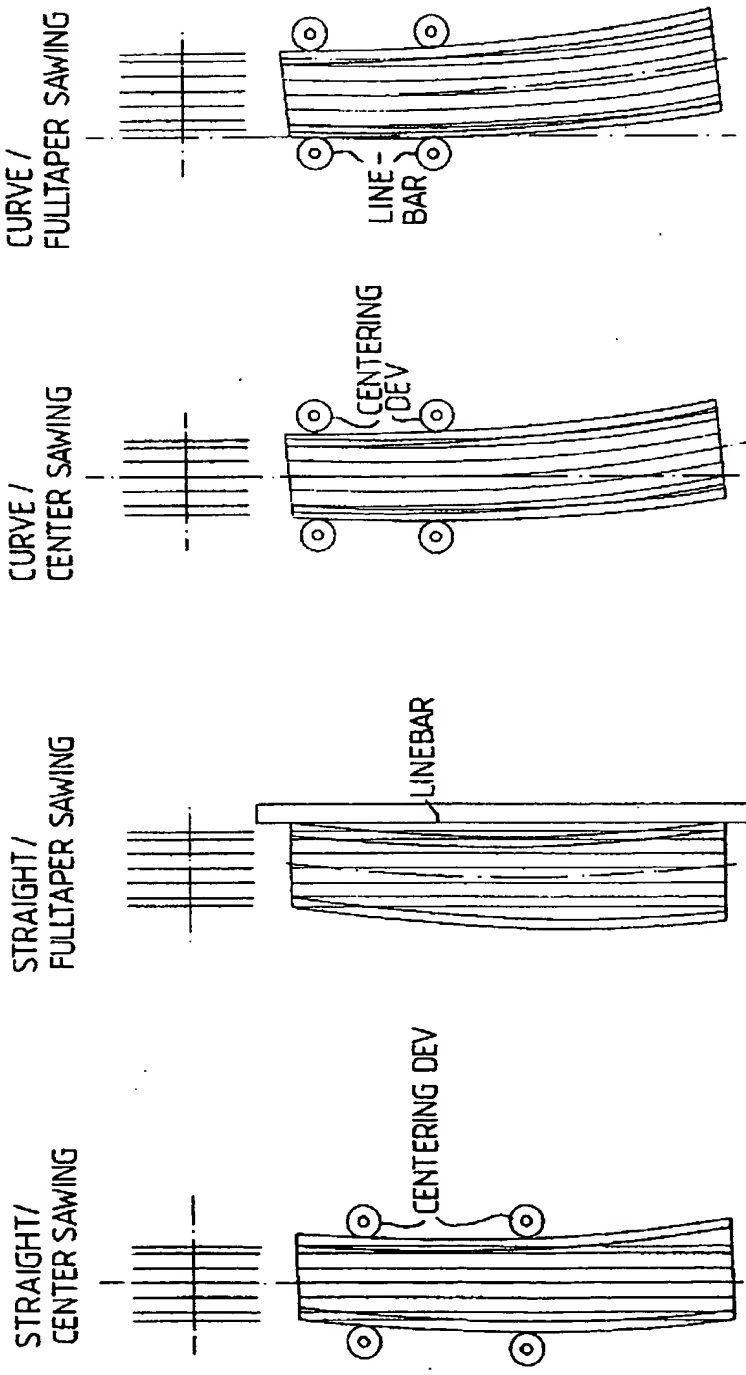

FIG.1A

FIG.1B

FIG.1C

FIG.1D

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Gowling, Strathy & Henderson